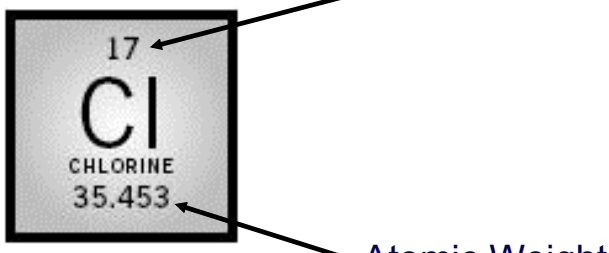
Chemistry

Review of Grade 9 Chemistry



Number of Protons?

Number of Electrons?

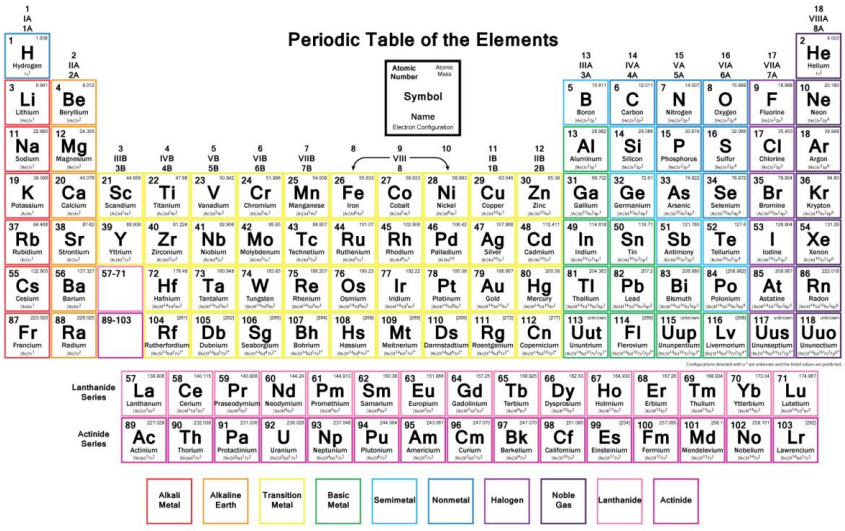
Number of Neutrons?

Valence Electrons

Electrons are found in shells (think orbits) surrounding the nucleus of an atom.

Valence Electrons are electrons located on the outside shell and are the electrons available for chemical bonding.

Groups or Families of electrons are related based on the number of valence electrons.



Determine the number of Valence Electrons in each of the following:

1. Carbon
2. Phosphorus
3. Barium
4. Argon
5. Krypton

Electron Dot Diagrams

Purpose: used to represent the number of valence electrons in an atom.

Steps: (Phosphorus)

1. Write the symbol of the atom you are drawing.

P

2. Determine the number of electrons in one atom of the element.

Electrons = 15

3. Find the number of valence electrons.

Valence Electrons = 5

4. Place the electrons around the symbol in a counterclockwise fashion starting on the right side.

Elements want to become inert (unreactive) by having an octet (8 electrons in the valence shell). This can be done through ionic or covalent bonding.

Create an electron dot diagram for each of the following:

1. Carbon

2. Phosphorus

3. Barium

4. Argon

5. Krypton

Lewis Structures

Are diagram used to represent the bonding (joining) elements to form ionic compounds and or covalent compounds.

Ionic Compounds - bonding of a metal and a nonmetal.

example: calcium bonding with oxygen

Covalent Compounds - joining of two nonmetals.

example: carbon bonding with oxygen

Ionic Compounds

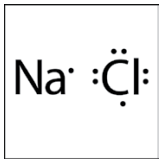
Elements want to become inert (contain 8 electrons in their valence shell). To do this elements can either gain (receive) or lose (donate) electrons.

Atoms that gain electrons have a negative charge and are called anions. Atoms that lose electrons have a positive charge and are called cations.

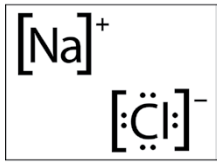
Ionic Compounds are created when a metal (cation) joins with a nonmetal (anion) to create an ionic compound (no net charge).

Representing Ionic Compounds Using Lewis Structures

Using Sodium and Chlorine as an example.

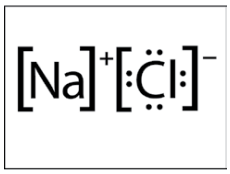


1. Determine the number of valence electrons in each element.



2. Metals will donate electrons and become positively charged while nonmetals will receive electrons and become negatively charged .

(the total positive or negative charge will be equivalent to the number of electrons donated or received)



3. Join the cation and the anion

Represent the bonding of the following elements into Ionic Compounds using Lewis Structures

1. Barium and Oxygen

2. Potassium and Nitrogen

3. Calcium and Fluorine

4. Magnesium and Nitrogen

Rules for Naming Ionic Compounds

Example: NaCl

1. The name of the cation is written first, followed by the anion.

2. The cation's name is what you see on the periodic table. On the other hand the anion is named by adding -ide to the stem name of the element from which the ion is derived.

NaCl - Sodium chloride

Practice

1. MgO
2. BaF
3. KO
4. NaN
5. CaS
6. LiCl

Rules for Writing Formulas for Ionic Compounds

Example: Sodium chloride

1. Write down the symbols of the ions involved.

2. Determine the lowest whole number ratio of ions that will give a net charge of zero. (Criss-Cross Method)

3. Write the formula removing all charges.

Practice

1. Cesium nitride
2. Beryllium chloride
3. Magnesium oxide
4. Aluminum fluoride
5. Calcium iodide
6. Potassium sulfide

Multivalent Ionic Compounds

Most transition metals are multivalent - have more than one ion form.

Exceptions Cd (2^+), Zn (2^+), and Ag (1^+)

Example: Copper has 2 ion forms:

Ca^+ or Ca^{2+}

Writing names for Multivalent ions

- We need to distinguish between the two or three different ion forms.

- Use roman numerals I - VII which corresponds to 1^+ - 7^+ ion charges

Example:

Ni^{2+}	and	Ni^{3+}
Nickel (II)	and	Nickel (III)

Ion Charge	Roman Numeral
1	I
2	II
3	III
4	IV
5	V
6	VI
7	VII

Steps for writing formulas for multivalent compounds

Example: Titanium (IV) fluoride

1. Identify each ion and its charge.
2. Determine the total charges needed to balance the positive and the negative.
3. Use subscripts to write the formula, 1's are not shown in subscripts.

TiF_4

Practice

1. Magnesium (III) sulfide
2. Titanium (III) fluoride
3. Nickel (II) oxide
4. Lead (IV) sulfide
5. Vanadium (V) oxide
6. Titanium (IV) fluoride

Writing Names for Multivalent Compounds

Example 1: FeI_2

1. Identify the multivalent metal.
2. Determine the ratio of ions in the formula.
3. Balance the positive and negative charges.
4. Write the name using roman numerals in brackets.

Iron (II) iodide

Example 2: PbF_4

Practice

1. $CrBr_3$
2. TiO_2
3. $AuCl_3$
4. $SnCl_4$
5. Fe_2O_3
6. AgI

Polyatomic Compounds

Contain three or more elements.

Polyatomic ions are electrically charged collection of two or more atoms that range in charge from 1^+ to 4^-.

Typically the polyatomic ion is located at the end of the compound with the exception of NH_4^+ which is found at the beginning of the compounds.

Writing Formulas for Polyatomic Compounds

Example: Lead (II) sulfate

1. The cation is written first followed by the anion.
2. When the formula contains two or more of the same polyatomic ion, the ion is written in parentheses with the subscript written outside the parentheses.

Remember not to change the ending of polyatomic ions.

$PbSO_4$

Practice

1. Calcium phosphate
2. Barium hydroxide
3. Ammonium chloride
4. Iron (III) chlorite
5. Magnesium nitrate
6. Manganese (I) nitrite

Naming Polyatomic Compounds

Example: $CaSO_4$

1. Determine which ion is the polyatomic ion.
2. Follow naming procedures associated with naming ionic compounds.

Calcium sulfate

Practice

1. NH_4Cl
2. $Ba(OH)_2$
3. $FeNO_3$
4. Cu_2SO_4
5. $MnClO_4$
6. $AlPO_4$

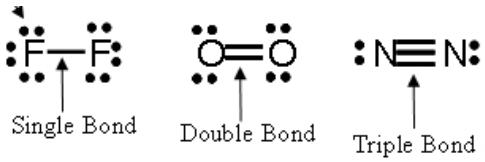
Molecular Compounds

Compounds created through the bonding of two nonmetals. These compounds contain covalent bonds.

Covalent bonds are formed when two elements **share** electrons.

Lewis Structures and Molecular Compounds

When molecular compounds are formed the elements involved share their electrons and create bonds (single, double, or triple depending on the number of electrons shared.



Create a Lewis Structure to represent the bonding of the following elements.

1. H_2O
2. $SbBr_3$
3. ClO_2
4. N_2O_3
5. CO
6. Si_2Br_6

Naming Molecular Compounds

Example: H_2O Dihydrogen monoxide

1. The name of the first element is written in full.
2. Change the ending of the name of the second element by adding the suffix 'ide'.
3. Add prefixes to the names to indicate the number of atoms present with the exception that mono is not used on the first element.

Prefix	Number
mono	1
di	2
tri	3
tetra	4
penta	5

Practice

1. H_2O
2. $SbBr_3$
3. ClO_2
4. N_2O_3
5. CO
6. Si_2Br_6

Writing Formulas for Molecular Compounds

Example: Carbon monoxide

1. Determine the elements involved.
2. Use the prefixes to determine the number of each element present.

CO

Practice

1. Boron trifluoride
2. Chlorine trifluoride
3. Carbon dioxide
4. iodine monochloride
5. Nitrogen trihydride
6. Nitrogen monoxide

Acids and Bases

Acids and bases exist everywhere. Almost every liquid in our lives is either an acid or a base.

Exception?

There is no one set definition of an acid or base, today there are thr working definitions.

Acids can be divided into two groups

- Binary acids - have two elements
- Oxyacids - have three elements, on of which is oxygen

Naming Acids

An easy way to recognize that a compound is an acid is that the formula will start with an H. (exception: acetic acid)

Binary Acid - contain two elements (H and ____)

Rules:

1. Ignore the H. It will eventually become the word acid.
2. The word **Hydro** is written as a prefix followed by the **root** to the nonmetal element followed by an **ic** ending.

Example: HCl - Hydrochloric acid

Oxyacids - contain three elements (H and ____ + ____)

Rules:

1. ate ions make ic acids. Example: H_2SO_4 - sulfuric acid
2. ite ions make ous acids. Example: H_2SO_3 - sulfurous acid

Practice

1. H_3PO_4
2. HBr
3. CH_3COOH
4. HNO_3
5. HNO_2

Writing Formulas for Acids

Example: Chloric acid

1. When writing a formula for an acid begin by writing the letter H. The represents Hydrogen. The number of H ions present in the compound depends on the charge of the second ion being used to create the acid.
2. Determine the type of acid (binary or oxyacid) by examining any prefixes or suffixes.

$HClO_3$

Balancing Chemical Equations

Law of Conservation of Mass

Counting Atoms

Classifying Chemical Reactions